Economics II

Long Run Economic Growth, Part I

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PRODUCTION FUNCTION AND SOLOW MODEL OF ECONOMIC GROWTH

The aim of the lecture is to analyze and explain key determinants of long-term economic growth (potential GDP growth) and the possibility of activating them as a prerequisite for improving the living standards of the population and creating economic assumptions for strengthening the country's defense.

Content:

- Introduction
- Production function and neoclassical model of long run economic growth
- Sollow model of long run economic growth
- Conclusion – summary, list of tasks for students

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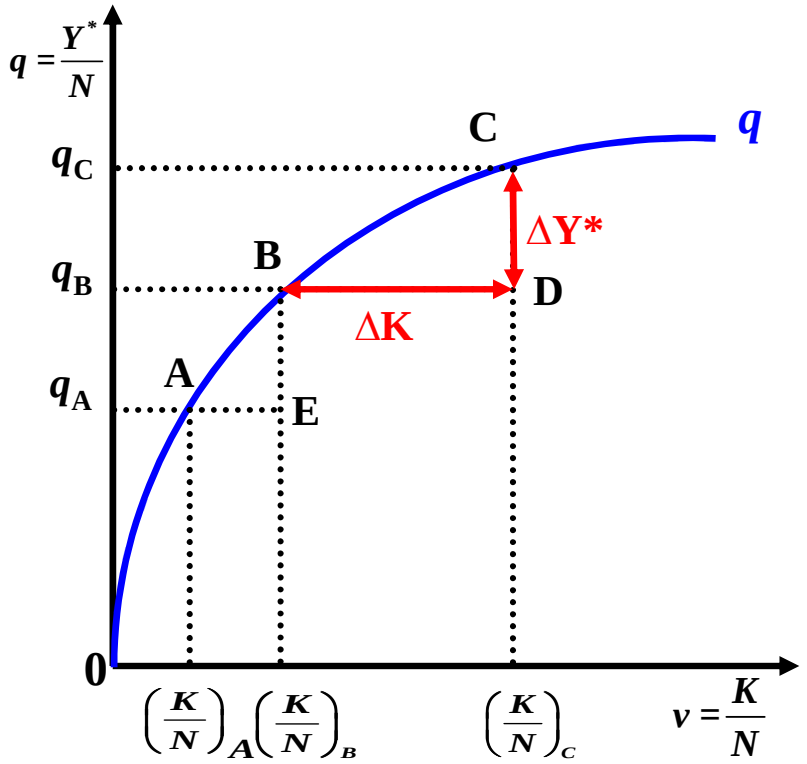
Basic terms and links

❖ *Intensive production function* $q = \kappa \cdot f(v)$

Intensive production function establishes the possibility of substitution between capital and labor, as every point of this function is the ratio of average labor productivity (q) and capital intensity (v).



The average labor productivity (q) can be increased:

a) either by increasing capital intensity, i.e. moving along the intensive production function;

b) or increasing the level of technology used, i.e. shift from the "lower" intensive production function to a "higher" intensive production function or shift of intensive production function upward;

c) as a result of increasing capital intensity, and consequently of increasing level of the used technology, i.e. introduction of technological progress.

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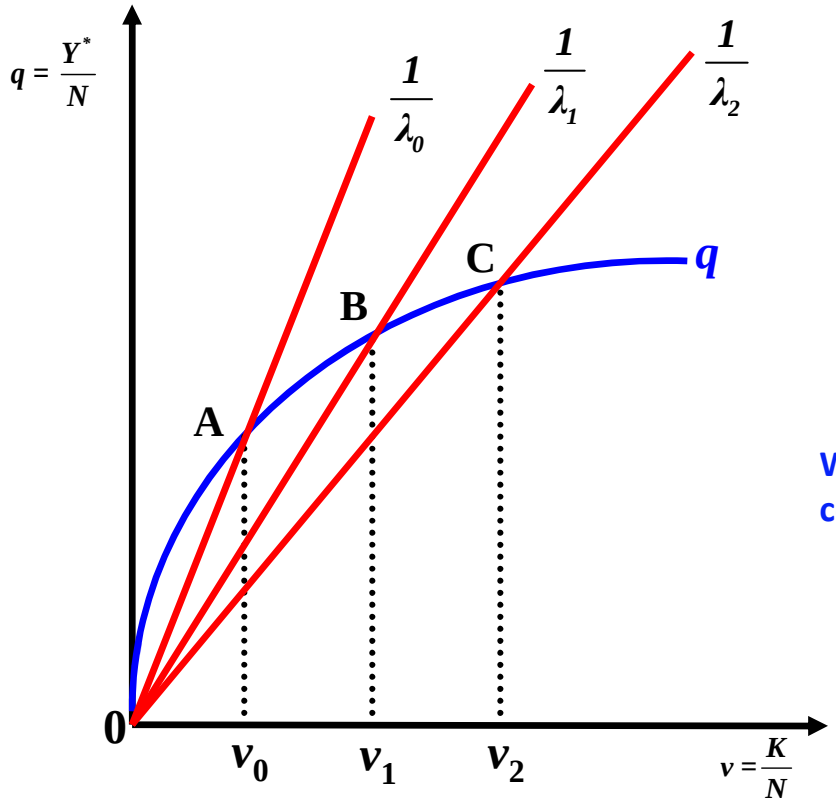
Intensive production function and capital coefficient



Intensive production function establishes the possibility of substitution between capital and labor:

$$\frac{q}{v} = \frac{Y^*/N}{K/N} = \frac{Y^*}{K} \qquad \frac{q}{v} = \frac{1}{\lambda}$$

Capital coefficient: $\lambda = \frac{K}{Y^*}$

When moving from point A to B and to C, capital coefficient increases, it means the following:

$$\frac{1}{\lambda_0} < \frac{1}{\lambda_1} < \frac{1}{\lambda_2}$$

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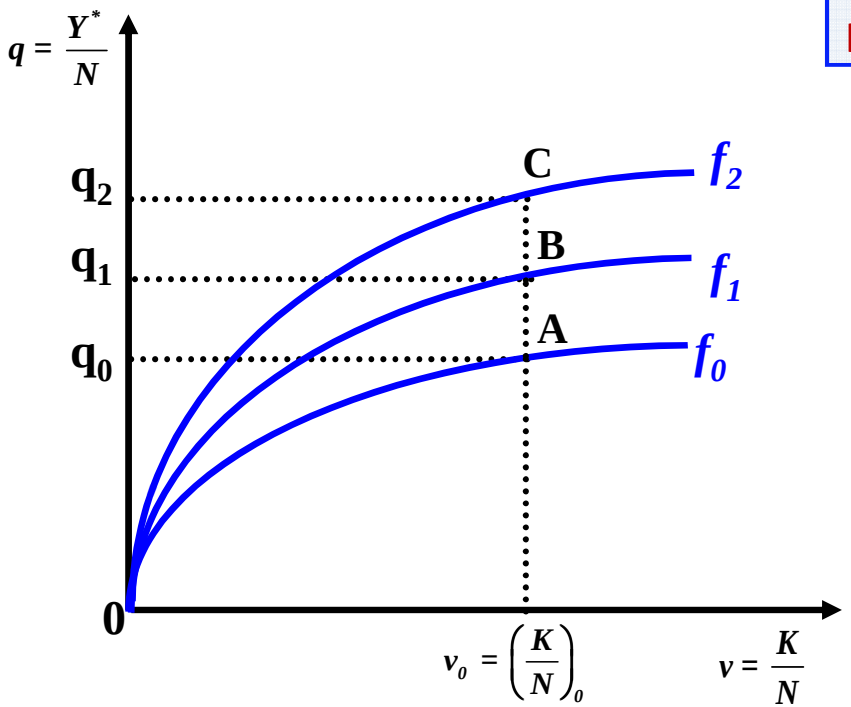
Movement along the intensive production function and its shift upward due to technological progress



The average labor productivity (Y */N) can be increased:

a) by increasing capital intensity, i.e. moving along the intensive production function;

b) by increasing the level of technology, i.e. a shift to a "higher" intensive production function or shift of intensive production function upward;

c) as a result of capital intensity growth, and consequently by increasing the level of the technology, i.e. by technological progress.

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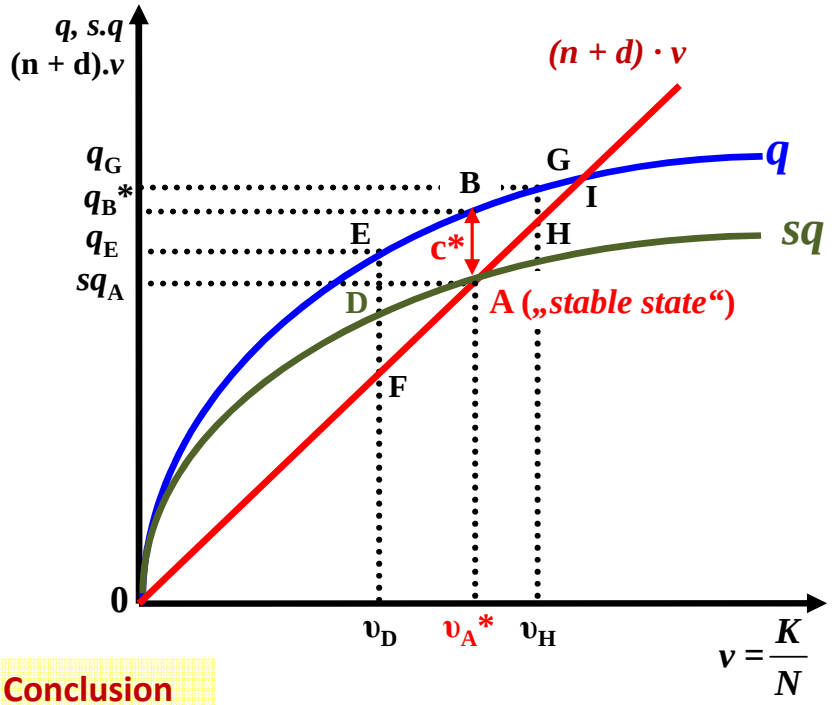
Stable (steady) state as long run equilibrium constant rate of product, capital and labor



Conclusion

- ✓ **Regardless of the initial level of capital intensity, economy converges to a point A, where the coefficient of capital intensity is constant, i.e. to the point where Δv = 0.**
- ✓ ***Economy converges to the stable (steady) state where long term equilibrium growth equals the growth rate of the population (n).***
- ✓ ***The level of labor productivity per capita is constant in this stable (steady) state.***

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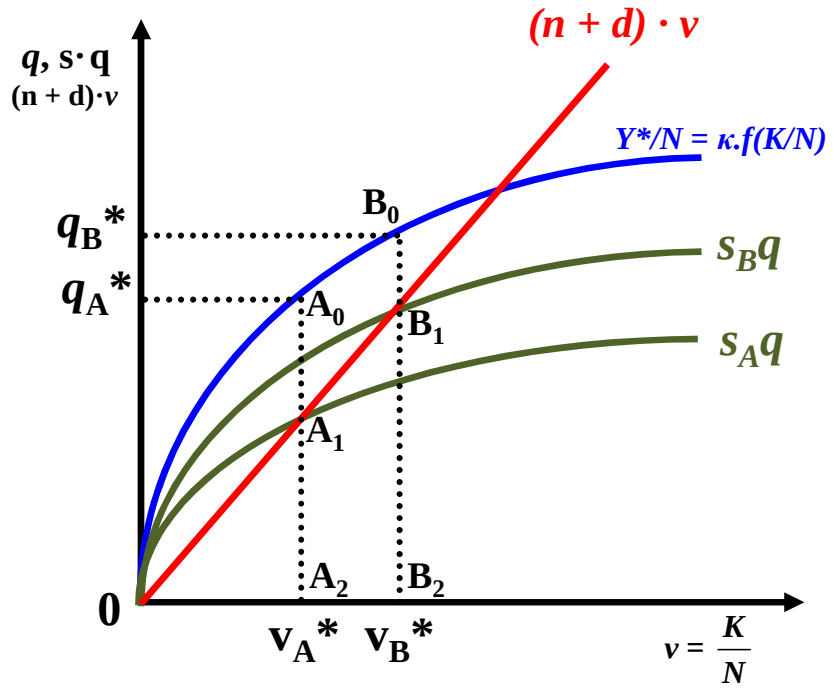
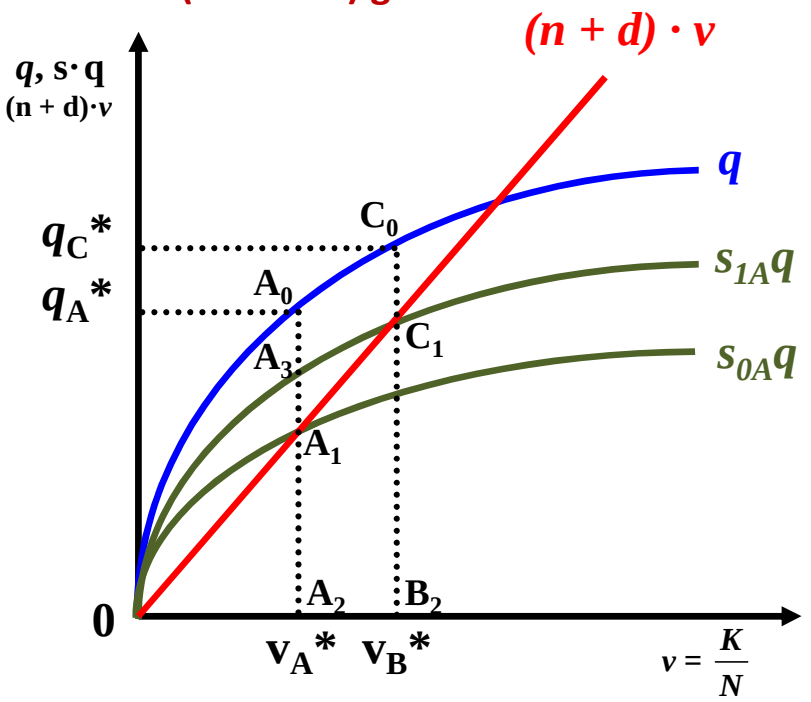
Effect of different savings rates on the average labor productivity and the growth rate of the product



Once the economy reaches stable (permanent) steady growth rate, economies have the same potential GDP growth rates regardless of their various propensities to save and capital accumulation rates.

Effect of an increase in the saving rate on stable (constant) growth



Increase in national saving rate will temporarily increase potential GDP growth rate above the population growth and will permanently increase the average level of labor productivity and capital intensity coefficient. The growth rate of average labor productivity in constant in the new stable (steady) state.

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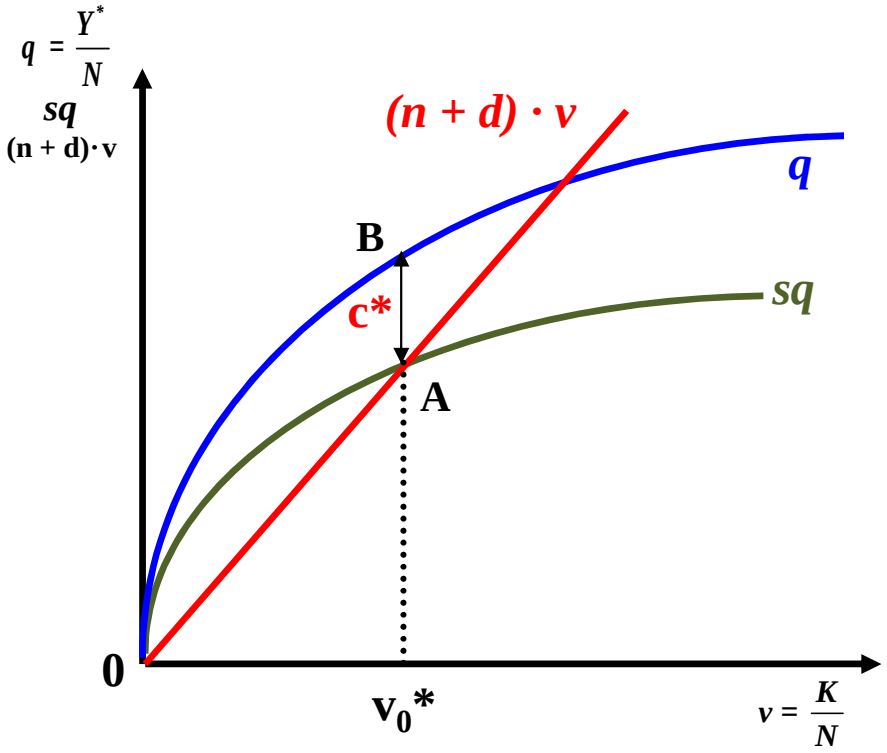
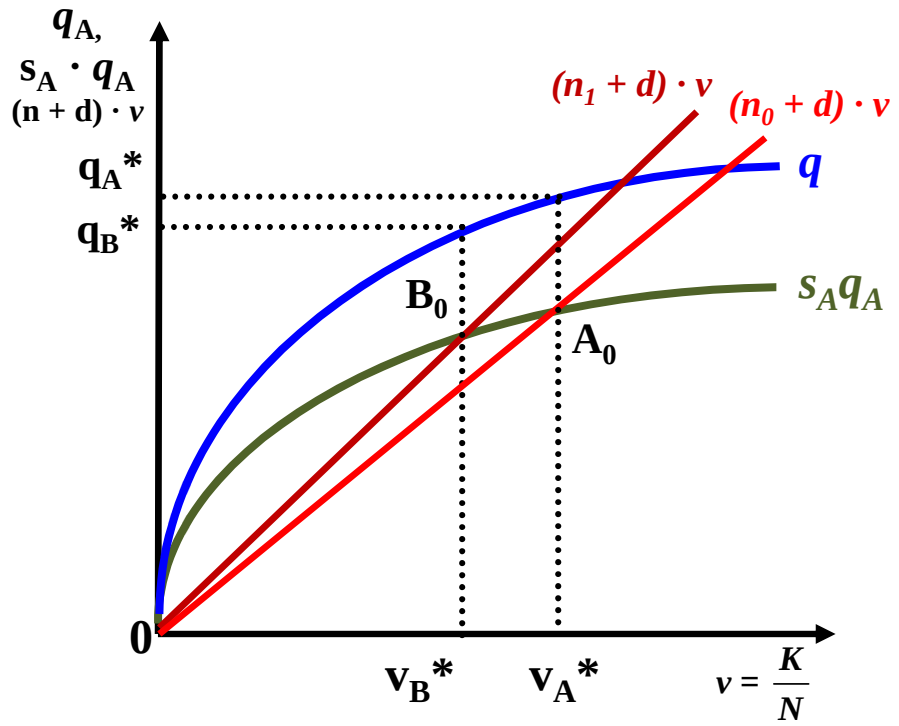
Optimum growth and the golden rule of capital accumulation



Effect of increased „n“



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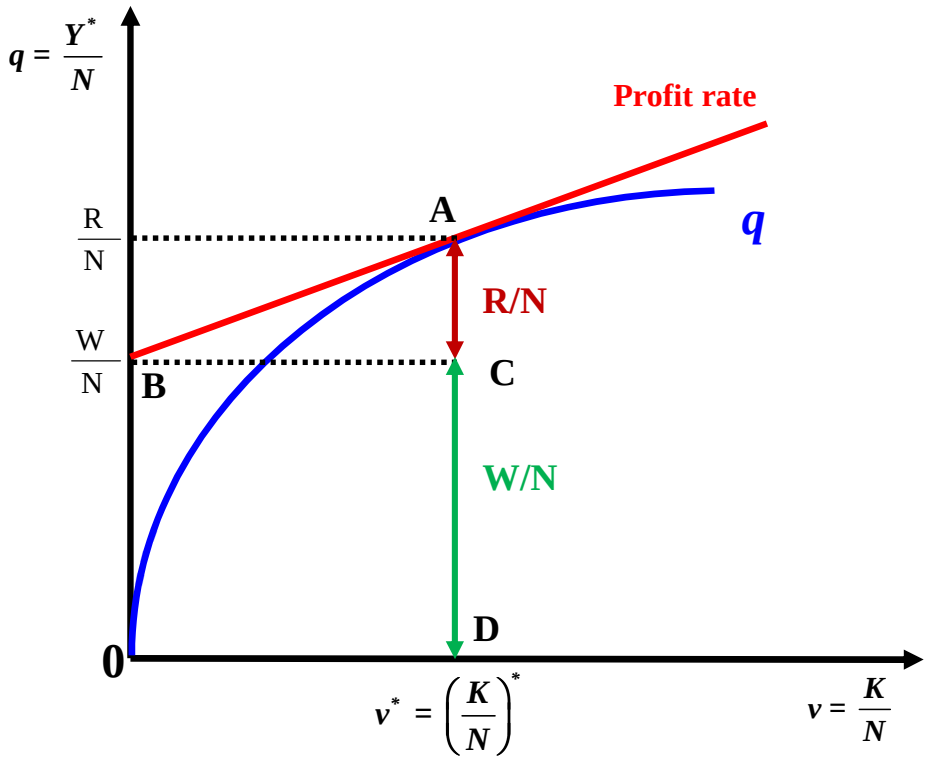
The neoclassical model of growth and distribution of the product per capita between wages and profits

$$Y^* = f(K, N) \ \ldots \ Nf(K/N)^*$$



$$W/N = Y^*/N - R/N$$

$$W/N + R/N = Y^*/N$$

Once the economy reaches stable (permanent) state, i.e. coefficient of capital intensity is v* and average productivity per capita reaches the level q *, the distribution of the product per capita between wage per capita and profit per capita is constant.

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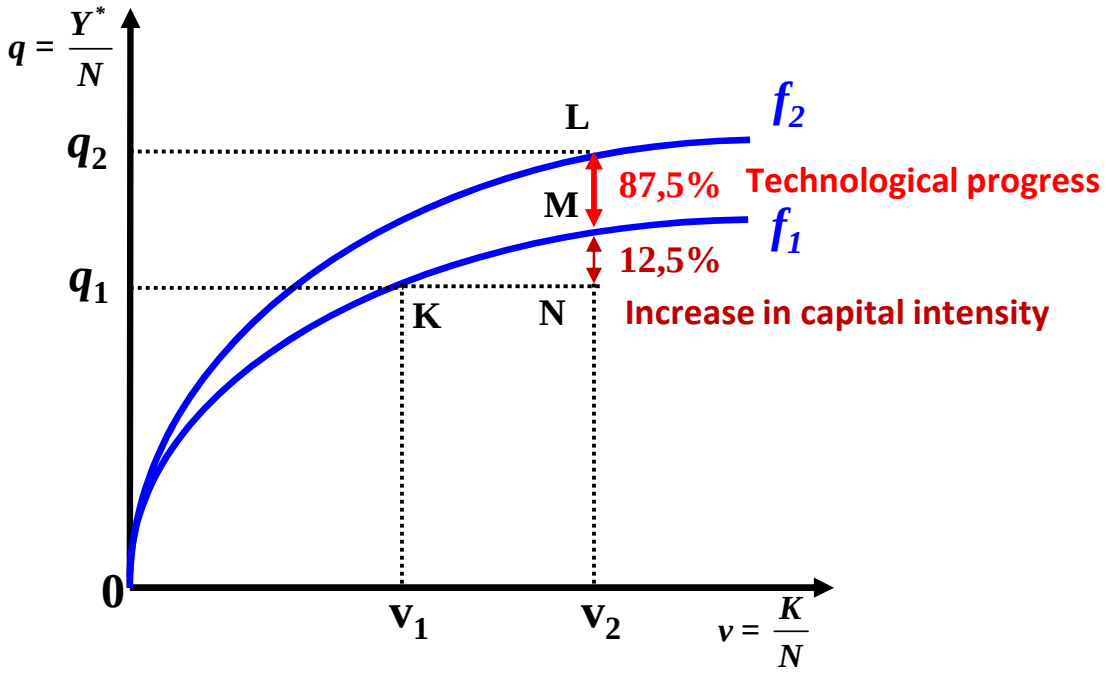
Long run economic growth including technological progress



R. M. Solow distinguished the following types of technological progress:
a) expanding the labor, i.e. technological advances made each hour of work more effective;
b) neutral, i.e. the technological progress affects both factors of production (labor and capital).

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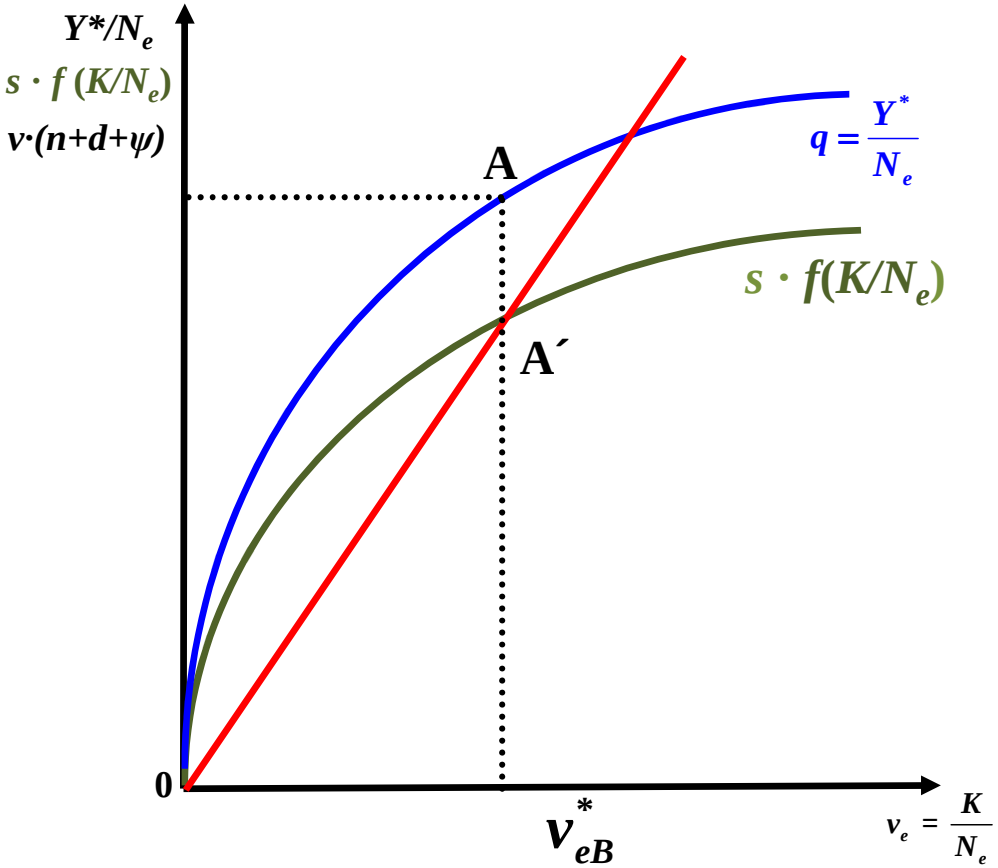
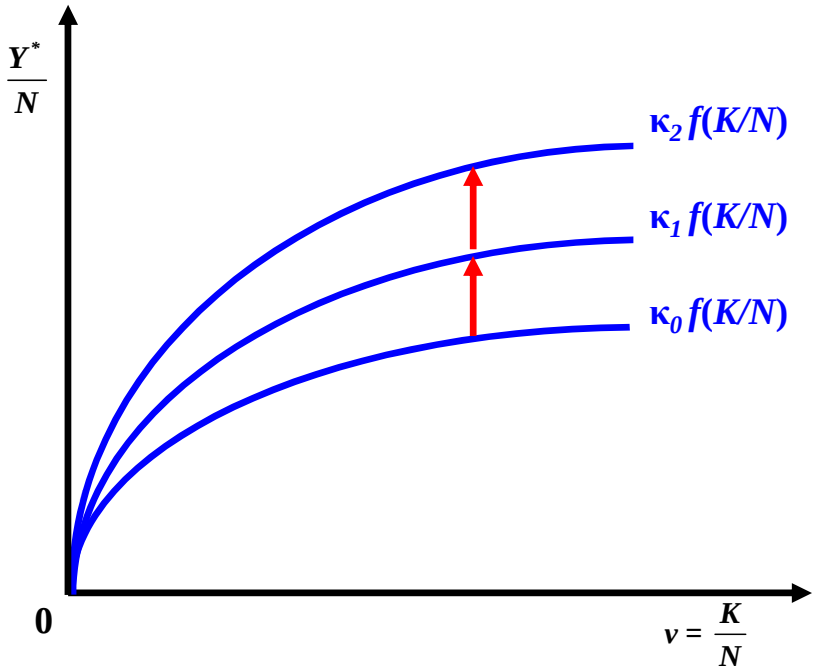
Solow model of long-term economic growth with technological progress extending the labor and neutral technological progress

Technological progress extending the labor



Neutral technological progress



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List of tasks for students

Exercise **„Neoclassical (exogenous) model of economic growth“**

1. Explain standard aggregate production function and its intensive form.
2. Using the basic equation of growth accounting analyze determinants of potential product (income) growth.
3. Explain the role of savings in the long-term economic growth and analyze the fundamental equation of capital accumulation.
4. Characterize stable (steady) state of the economy, optimum growth of the potential product and the golden rule of capital accumulation.
5. Explain the gains of technological progress as a factor in long-term economic growth.